Semi-Annual Report

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Task objectives

- Continue analysis of data from MODIS validation cruises
- Continue evaluation of MODIS imagery from several regions of the world ocean
- Continue development of software for MODIS Direct Broadcast facility for cruise support

Work Accomplished

Evaluation of MODIS imagery

Much of our effort has focused on the evaluation of algorithms for reprocessing the MODIS data (collection 4). It is worth noting that in the 041 collection (shown below, courtesy Wayne Esaias) that the three MODIS chlorophyll products are internally consistent with each other. However, the SeaWiFS chlorophyll product shows a slower decline after the spring bloom and no fall bloom as observed in the MODIS data. The bottom panel shows FLH, which is calibrated separately from the bands used to derive chlorophyll. It also relies on a much simpler atmospheric correction process. Note that FLH shows a more rapid decline after the spring bloom, consistent with the pattern observed in the MODIS chlorophylls. There is also evidence of a fall bloom in FLH, except in 2001. Again, this is consistent with the MODIS chlorophylls. There are two possible explanations. First, an incorrect correction of the SeaWiFS near-infrared bands would produce anomalously high chlorophyll values in summer. Second, there may be more CDOM in post-bloom waters where is not being accounted for in the SeaWiFS algorithms. Both explanations demonstrate the difficulties associated with absorption-based algorithms to derive chlorophyll.

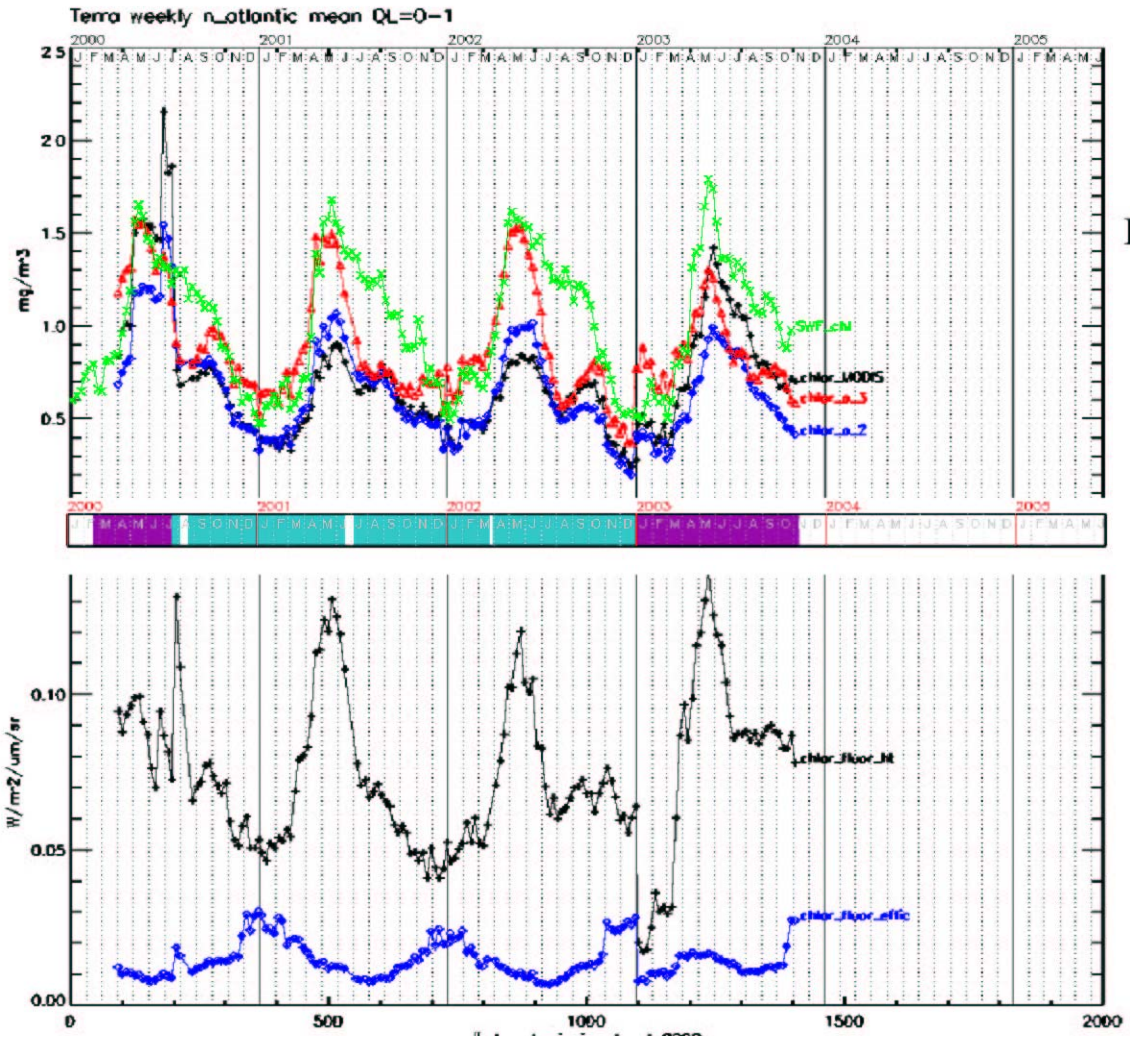

Figure 1 Time series of chlorophyll from MODIS and SeaWiFS (top). Time series of FLH and CFE (bottom). Figure courtesy of Wayne Esaias, NASA/GSFC.

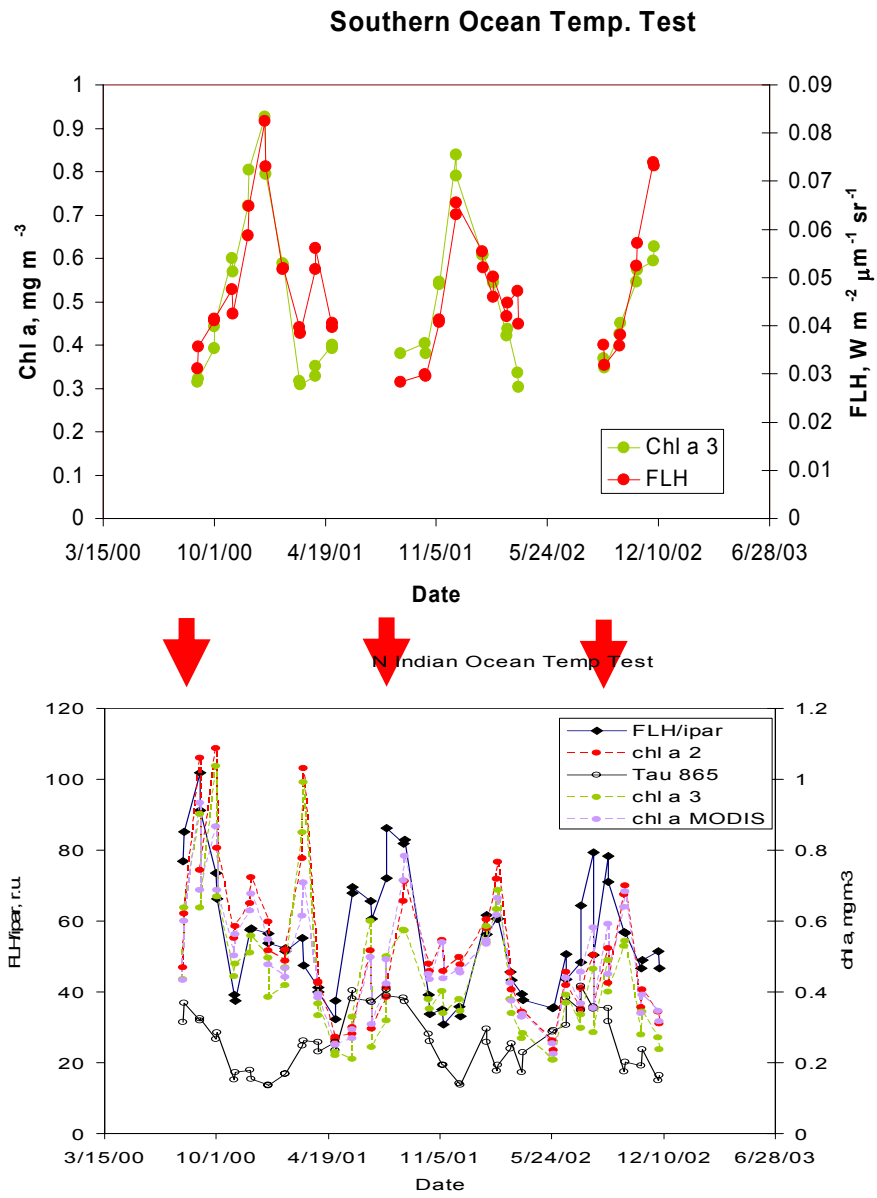

Figure 2. Temporal test of FLH and chl_a3 (Carder chlorophyll) in the Southern Ocean (top). Comparison of MODIS chlorophyll with FLH/iPAR. The arrows highlight periods of high aerosol optical thickness.

Figure 2 (top) shows that at high latitudes, FLH is a good predictor of chlorophyll. although there is a hint of a secondary bloom in FLH. At lower latitudes (Fig. 2, bottom), FLH/iPAR is a better proxy of chlorophyll than FLH by itself. There is some evidence that when the aerosol optical thickness is high that chlorophyll algorithms underestimate the chlorophyll content (note the periods highlighted by the red arrows in Fig. 2, bottom). Similar results were noted during the large forest fires in 2002 in Oregon. Fig. 3 (top) shows impacts of these fires on the atmosphere during the Wecoma validation cruise. Figure 3 (bottom) shows the horizontal extent of the smoke plumes. MODIS data fields showed the same pattern of chlorophyll underestimation under the smoke plume compared with the

smoke-free areas. FLH was much less sensitive to changes in aerosol optical thickness, as expected. These results demonstrate the value of the MODIS fluorescence bands, especially in areas such as coastal zones where both the atmosphere and the ocean have much more complicated optical properties.

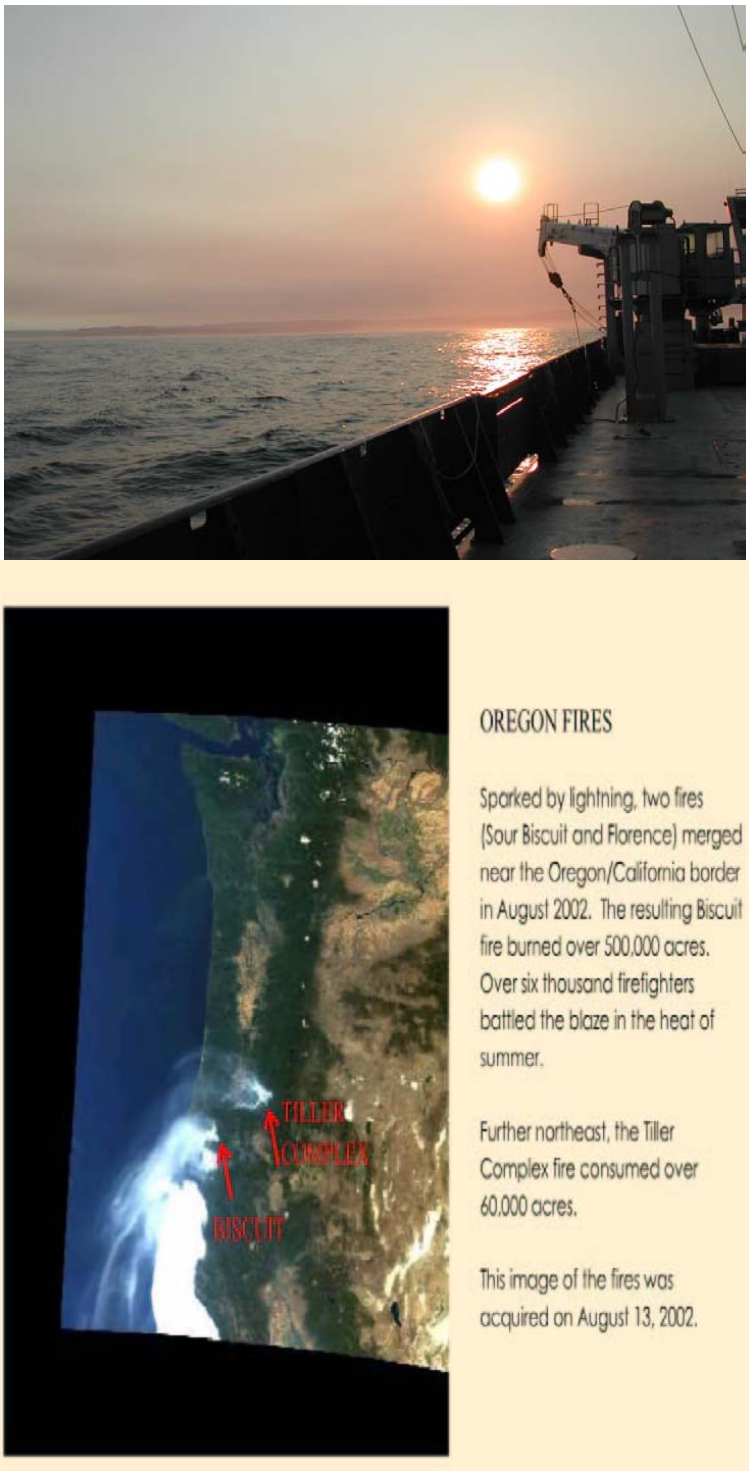

Figure 3. Smoke from Oregon forest fires as seen from the deck of the R/V Wecoma in August 2002 (top). MODIS visible image of the Oregon forest fires (bottom).

Direct Broadcast

Our EOS Direct Broadcast facility (http://picasso.oce.orst.edu/ORSOO/MODIS/DB) continues to operate. We are now ingesting MODIS DB data collected at the University of Hawai'i, thus providing a nearly complete view of the NE Pacific Ocean. The data are immediately available for public use from our website:

http://picasso.coas.oregonstate.edu/ORSOO/MODIS/DB/

This site provides access to the data in a number of ways: 1) quick views of the most recent data collected, 2) search and order archived data, 3) subscribe to real-time data as it is collected, 4) interactively create figures of the most recent data, and 5) view interesting past images in a gallery. This site also provides information on upcoming TERRA and AQUA passes to help with cruise planning. All data are also available via anonymous FTP on request.

A web-service view to our MODIS DB data is being constructed to enable the development of end-user applications that transparently "consume" the data and services provided by COAS. This consists of a layer that resides on a web-server and provides building-block type services. These services enable processing of the data on the server, such as the extraction of a subset of pixels or extracting data that corresponds to a scientific feature. Once the building-block type services have been implemented, we plan to combine them in meaningful ways to solve more complex problems. We have developed several complex web services, and we are just completing testing of these services.

We have submitted a proposal to NASA to continue support and development of the MODIS DB site.

Community Outreach

We have been revising and updating the documentation of the MODIS Oceans processing software. Rather than use an HTML-based document, we decided that creating a single PDF file was more useful. The document is being revised with the close collaboration of researchers at the University of Miami. A draft of the document can be seen at:

http://picasso.coas.oregonstate.edu/ORSOO/MODIS/code/MODP.pdf

We hosted a workshop on MODIS Oceans products in September 2003. From the feedback we have received to date, it appears that the workshop which was held at Oregon State University was a success. We had 39 registered participants and 12 presenters. Although most participants came from the West Coast of the United States, several Canadian, British, Central and South American students and researchers also took advantage of this workshop. The complete list can be found at:

http://picasso.coas.oregonstate.edu/ORSOO/MODIS/workshop/form-registration.html

We requested all participants to provide a critical assessment of the workshop and designed a web page where they could enter comments. The idea behind this request was to obtain feedback in case other MODIS Ocean workshops are planned in the future.

To date, we have received 16 replies. Overall, they all contain positive comments regarding how this workshop helped them to better understand how MODIS ocean data are processed, distributed, and can be accessed and used by researcher. Most comments also had some suggestions regarding the duration of the workshop (two intensive days may not be sufficient), the size and acoustic of the classrooms, the presentation of the tutorials, and the quality of the lectures.

All comments received can be found at:

http://picasso.coas.oregonstate.edu/ORSOO/MODIS/workshop/form-comments.html

The tutorials, as well as the lectures given during the workshop, can be found at:

http://picasso.coas.oregonstate.edu/ORSOO/MODIS/workshop/

Anticipated Future Actions

- Continue testing and evaluation of MODIS fluorescence algorithms with MODIS data
- Analyze MODIS Aqua data
- Transition operations and development of the MODIS DB site.
- Prepare final report.

Problems and Solutions

No major problems were encountered.